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Environmental Research on Fish Habitat Restoration at Tilbury Slough, Fraser River Estuary, British Columbia.

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ABSTRACT

Kistritz, R. U. and J. S. Macdonald. 1990. Environmental research on fish habitat at Tilbury Slough, Fraser River estuary, British Columbia. Can. Data Rep. Fish. Aquat. Sci. 781: 65 p.

Data results are reported of measurements and samples taken in 1986 during flood and ebb tidal exchanges in a natural and channelized marsh in Tilbury Slough, Fraser River estuary. Results of tidal hydrology, temperature, conductivity, dissolved oxygen, total organic and inorganic carbon, dissolved and particulate organic carbon, detritus, and epibenthic drift invertebrates are reported. Also reported are fish catch records, their length-weight statistics, and stomach content data.

Key words: habitat restoration, Fraser River estuary, tidal marsh, juvenile salmon, detritus, epibenthos, fish diet

RÉSUMÉ

Kistritz, R. U. and J. S. Macdonald. 1990. Environmental research on fish habitat at Tilbury Slough, Fraser River estuary, British Columbia. Can. Data Rep. Fish. Aquat. Sci. 781: 65 p.

L'ouvrage présente les résultats de mesures et d'échantillonnages effectués en 1986, pendant le flot et le jusant, dans des marais naturels et artificiels de Tilbury Slough, à l'embouchure du Fraser. On y trouve des données sur l'hydrologie des marées, la température, la conductivité, l'oxygène dissous, la quantité totale de carbone organique et inorganiqu, les détritus et les invertébrés benthiques poussées par la marée. Sont également étudiés les registres des prises, les statistiques concernant la longueur et le poids des poissons et les données sur le contenu de leur estomac.

Mots-clés: restoration de l'habitat, embouchure du Fraser, marais maritime, saumon juvénile, detritus, domaine benthique, alimentation des poissons

INTRODUCTION

This data report presents tabulated data results of physical, chemical, and biological measurements made at Tilbury Slough during 1986. The report is complementary to a technical report by the same authors in preparation for publication in Canadian Technical Report of Fisheries and Aquatic Sciences which should be referred to for a complete introduction, description, and discussion of the research data. This report serves as a reference to those who require access to the original data.

The Tilbury Slough research project was developed out of a need to improve our understanding of the ecological consequences of fish habitat restoration. Specifically at Tilbury Slough, we wanted to know whether the restored habitat would be attractive to juvenile salmon and how newly constructed channels affect key components of the estuarine ecosystem such as total particulate and dissolved organic carbon, detritus, and drift organisms. The study design included a comparison between the restored (enhanced) habitat and a natural (enhanced) tidal channel system located nearby in the same marsh. Objectives of the research were to made comparisons between physical, chemical and biological conditions of the enhanced and unenhanced sections of the Tilbury study site.

SAMPLING SITES AND DATES

The first sampling location was the dyke breach that provided tidal exchange between the Fraser River/Tilbury Slough and the system of channels created in the enhanced marsh area (site E). The second sampling location was in the opening of the dyke that leads to a natural system of tidal channels in the unenhanced marsh area (site U). The study site and sampling locations are shown in Figure 1.

Physical data and chemical data as well as drift organisms and detritus were sampled over complete tidal cycles on the following dates:

9 February 86	24 July 86
6 April 86	14 October 86
5 May 86	4 December 86
26 June 86	

Fisher were sampled approximately once every two weeks on the following dates:

5 May 86	2 June 86
19 May 86	16 June 86
22 May 86	30 June 86

Please note that dates on data tables are shown as dd/mm/yy (e.g. 09/02/86 = 9 February 1986).

METHODS

TIDAL HYDROLOGY

Water surface elevation (elev.) was measured at site E in order to calculate water volumes entering and exiting the study sites. Elevations to the nearest cm were measured at approximately one half hour intervals throughout the duration of each sampling period which consisted of one full tidal cycle (approximately 8 hours). Elevations were measured from a reference benchmark to the water surface.

Water velocities (Vel.) were measured at roughly half hour intervals over the course of a tidal cycle sampling period. A method of timing a floating object past a fixed distance was used to measure velocity. To estimate variation velocity measurements were taken in triplicate.

Water volume (Vol.) and surface area (Area) were calculated so that we could express the data obtained at the channel entrances on a per unit volume and per unit area basis. Surface areas at various elevations were determined by using a digital planimeter on a base map of the study site. Volumes were computed for each elevation increment between contour intervals.

TEMPERATURE CONDUCTIVITY AND DISSOLVED OXYGEN

Temperature measurement along with dissolved oxygen (D.O.), conductivity (Cond.) and water chemistry were made at roughly hourly intervals throughout an 8 hour sampling period covering a full tidal cycle. A YSI dissolved oxygen meter and conductivity meter were used.

ORGANIC CARBON

Total organic carbon (TOC) was estimated from triplicate samples taken six times throughout a complete tidal cycle; three triplicate samples during flood tide and three triplicate samples during ebb tide. Dissolved (DOC) and particulate organic (POC) carbon components were calculated from one of the triplicated TOC samples taken during each of the six time periods. Total inorganic carbon (TIO) in the samples was also estimated in triplicate. Samples were taken most frequently when tidal velocities were high since material loading rates were at peak level then. Water was collected in glass sample vials covered with a nitex mesh to exclude particulates greater than 0.1 mm in size. Samples were stored in a refrigerator and analyzed within 6 hours using the combustion-infrared method (Standard Methods 1981).

DRIFT ORGANISMS AND DETRITUS

Drift organisms and detritus (particulate organic matter >0.1 mm) were sampled continuously through the flood and ebb cycles of each sampling period. A net (square opening of 30 by 30 cm, 0.1 mm mesh size) was placed in the bottom of each channel entrance with the opening facing into the current. The nets were emptied at each slack tide. Samples were frozen for later analyses. In the laboratory invertebrates were sorted, identified, counted and weighed. All detrital material contained in the sample was ashed to determine total organic content.

FISH

A beach seine net was used to close off each channel entrance at high slack tide thereby trapping all fish that had entered on the previous flood tide. Catches are reported as occurring between the time of the low tide before the entrance was closed off by net and the time of the low tide in which the fish were collected from the net. As the marsh and channel system drained, fish were trapped at the channel entrance. When only a shallow pool of water remained, the net was carefully pursed and fish were removed. In the laboratory, fish were sorted, identified, measured and weighed. Up to 15 stomachs per salmonid species were examined and prey items identified and enumerated.

RESULTS

Data are presented in tables separated by data type and collection data. Table 1 shows calculated water surface areas and volumes at various Geodetic elevations at site E and site U. Other physical data provide values for the variables times, elevation, water velocity, volume and surface area, temperature, conductivity, and dissolved oxygen (Tables 2 to 8). Chemical data are presented in Tables 9 to 15 and include time, water volume and surface area, and total, dissolved and particulate organic carbon. Biological data include drift net catches (Tables 16 to 22), fish catch records (Tables 23 to 28), juvenile salmon length-weight statistical summaries (Tables 29 to 33), and juvenile salmon stomach contents (Table 34 to 38).

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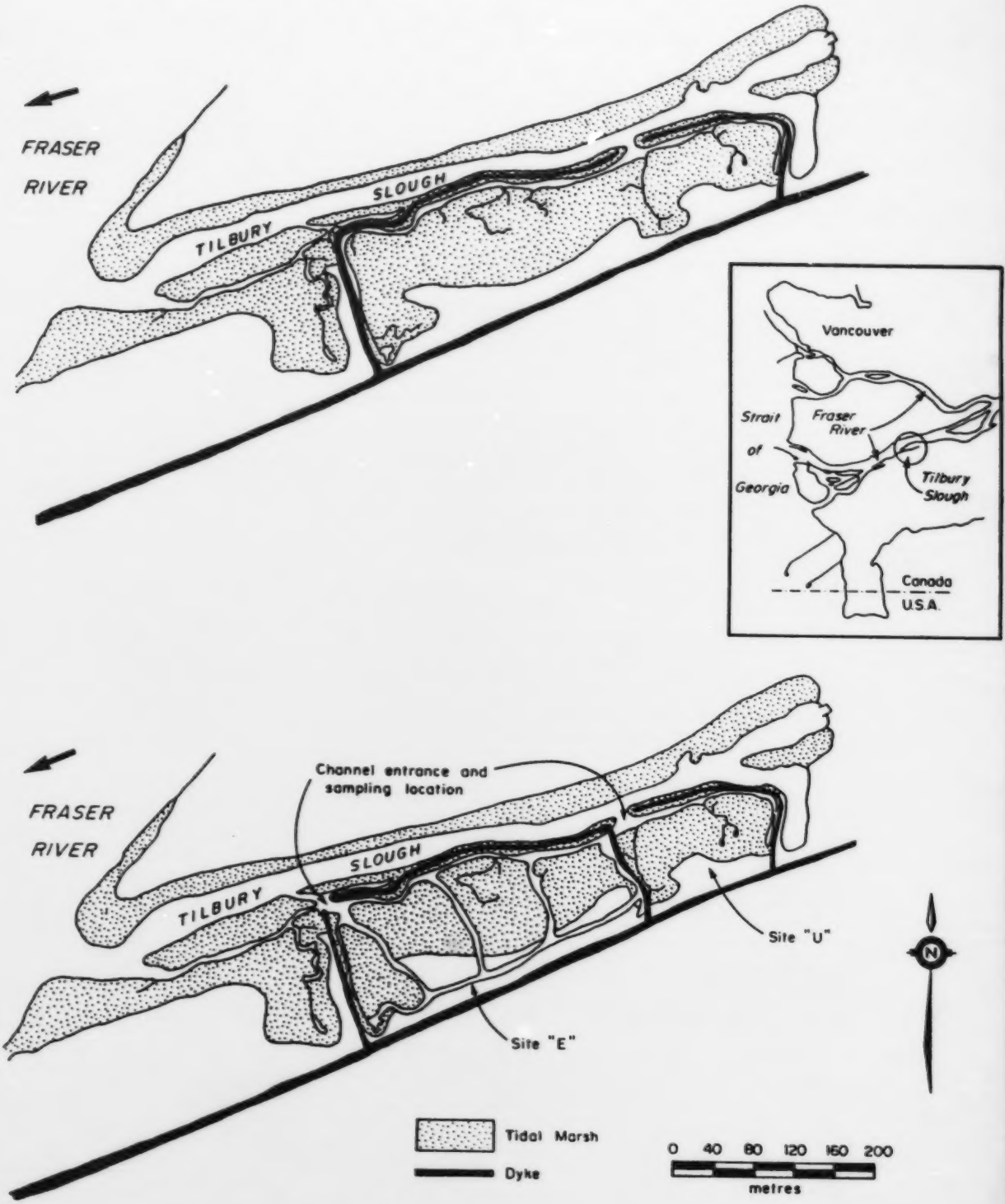

Figure 1. Sampling location in enhanced (site E) and unenhanced (site U) areas of Tilbury Slough.

Table 1. Water surface areas and volumes.

ELEVATION above Geodetic datum	AREAS AND VOLUMES			
	Area-E	Area-U	Volume-E	Volume-U
metres	sq. m.	sq. m.	cu. m.	cu. m.
2.00	34100	13900	28080	11166
1.95	33975	13838	26378	10473
1.90	33850	13775	24682	9783
1.85	33725	13713	22993	9095
1.80	33600	13650	21310	8411
1.75	33400	13588	19635	7730
1.70	33200	13525	17970	7053
1.65	32700	13463	16322	6378
1.60	32200	13400	14700	5706
1.55	31361	13088	13111	5044
1.50	30521	12775	11564	4398
1.45	28458	10869	10089	3807
1.40	26394	8963	8718	3311
1.35	23927	7622	7460	2896
1.30	21459	6280	6325	2549
1.25	17596	5174	5349	2262
1.20	13733	4068	4566	2031
1.15	11490	3878	3935	1833
1.10	9246	3686	3417	1643
1.05	6977	2684	3014	1484
1.00	4508	1680	2729	1375
0.90	3200	1594	2344	1211
0.80	3012	1509	2033	1056
0.70	2824	1423	1741	910
0.60	2635	1337	1468	772
0.50	2447	1252	1214	642
0.40	2259	1166	979	521
0.30	2071	1080	762	409
0.20	1983	994	565	305
0.10	1694	909	386	210
0.00	1506	823	226	123
-0.10	1004	549	100	55
-0.20	502	274	25	14
-0.30	0	0	0	0

Table 2. Physical data for 9 February 86.

TIME (hrs)	ELEV. (cm)	VEL. (cm/s)	VOL. (cu.m)	AREA (sq.m)	TEMP. (deg)	COND. (mmhos)	D.O. (mg/l)
			ENHANCED SITE				
0400	3	19	226	1506			
0430					3.0	470	12.3
0454	76	31	2033	3012			
0558	135	44	7460	23927			
0604					3.3	750	12.8
0605							
0621	147	48	10089	28458			
0713	164	0	16322	32700			
0732	162	17	14700	32200			
0734					3.0	850	12.5
0737							
0845	127	28	5349	17596			
0902					3.0	650	12.0
0905							
0959	90	17	2344	3200			
1028	72	17	1741	2824			
1033					3.0	650	12.2
1035							
1145	33	13	762	2071			
1212	26	6	565	1883			
			UNENHANCED SITE				
0400			123	823			
0454			1056	1509			
0524					3.0	750	12.4
0530							
0558			2896	7622			
0621			3807	10869			
0645					3.0	800	13.0
0650							
0713			6378	13463			
0732			5706	13400			
0815					3.0	700	12.6
0820							
0845			2262	5174			
0931					2.5	700	11.4
0935							
0959			1211	1594			
1028			910	1423			
1110					2.8	850	12.0
1112							
1145			409	1080			
1212			305	994			

Table 3. Physical data for 6 April 86.

TIME (hrs)	ELEV. (cm)	VEL. (cm/s)	VOL. (cu.m)	AREA (sq.m)	TEMP. (deg)	COND. (mmhos)	D.O. (mg/l)
			ENHANCED SITE				
0132	18	19	565	1883	5.5	180	11.4
0138							
0217	66	30	1741	2824			
0231					6.0	220	11.8
0236	83	27	2033	3012			
0311	109	19	3417	9246			
0325					5.0	180	11.8
0403	134	25	7460	23927			
0421	138	15	8718	26394			
0439	140	0	8718	26394			
0512	133	21	6325	21459			
0532	125	23	5349	17596	5.0	280	11.8
0538							
0614	103	21	2729	4508			
0630					5.0	400	11.2
0714	70	17	1741	2824			
0753	45	18	1214	2447			
0800					6.0	470	11.0
0840	20	18	565	1883			
			UNENHANCED SITE				
0132			305	994			
0202					6.0	280	10.6
0217			910	1423			
0236			1056	1509			
0256					5.5	340	10.6
0311			1643	3688			
0350					5.5	330	11.5
0403			2896	7622			
0421			3311	8963			
0439			3311	8963			
0512			2549	6280			
0532			2262	5174			
0600					5.0	390	11.2
0614			1375	1680			
0702					5.0	390	10.7
0714			910	1423			
0753			642	1252			
0830					6.0	290	10.4
0840			305	994			

Table 4. Physical data for 4 May 86.

TIME (hrs)	ELEV. (cm)	VEL. (cm/s)	VOL. (cu.m)	AREA (sq.m)	TEMP. (deg)	COND. (mmhos)	D.O. (mg/l)
			ENHANCED SITE				
0052	13		386	1694	10.5	260	9.2
0132	45	19	1214	2447	9.5	130	10.2
0151	64		1468	2635			
0222	90	23	2344	3200			
0242	105	19	3014	6877	9.5	180	10.8
0337	133	27	7460	23927			
0401	142	23	8718	26394			
0413	144		10089	28458			
0440	148	0	11564	30521			
0526	139	30	8718	26394	9.0	120	10.3
0618	113	21	3935	11490			
0656	91		2344	3200	9.5	175	9.0
0746	57	25	1468	2635			
0803	40		979	2259	10.0	200	9.0
0854	0	25	226	1506			
			UNENHANCED SITE				
0052	13		210	909			
0117					12.0	500	7.0
0132	45		642	1252			
0151	64		772	1337			
0206					10.0	240	8.8
0222	90		1211	1594			
0242	105		1484	2684			
0300					10.0	160	9.8
0337	133		2896	7622			
0401	142		3311	8963			
0413	144		3807	10869			
0440	148		4398	12775			
0526	139		3311	8963			
0558					10.0	180	9.3
0618	113		1833	3878			
0656	91		1211	1594			
0726					10.0	250	8.2
0746	57		772	1337			
0803	40		521	1166			
0833					10.5	390	7.0
0854	0		123	823			

Table 5. Physical data for 27 June 86.

TIME (hrs)	ELEV. (cm)	VEL. (cm/s)	VOL. (cu.m)	AREA (sq.m)	TEMP. (deg)	COND. (mmhos)	D.O. (mg/l)
			ENHANCED SITE				
1945	14	20	386	1694	16.0	190	9.4
2030	73	31	1741	2824			
2055	101	41	2729	4508	14.2	72	9.8
2139	142	61	8718	26394			
2151	154	61	13111	31361	14.0	80	10.0
2221	172	49	17970	33200			
2235	180	35	21310	33600			
2305	190	0	24682	33850			
0002	187	22	22993	33725			
0102	163	41	16322	32700	14.5	80	9.8
0138	145	49	10089	28458			
0228	114	31	3935	11490	14.0	80	8.8
0308	89	20	2344	3200			
0354	63	14	1468	2635	14.0	90	8.0
0436	46	12	1214	2447			
			UNENHANCED SITE				
1945	14		210	909			
2008					16.5	300	8.9
2030	73		910	1423			
2055	101		1375	1680			
2125					14.5	90	9.7
2139	142		3311	8963			
2151	154		5044	13088			
2206					14.0	80	9.8
2221	172		7053	13525			
2235	180		8411	13650			
2305	190		9783	13775			
0002	187		9095	13713			
0102	163		6378	13463			
0125					14.0	80	9.2
0138	145		3807	10869			
0228	114		1833	3878			
0252					14.0	80	8.3
0308	89		1211	1594			
0354	63		772	1337			
0417					14.0	180	7.8
0436	46		642	1252			

Table 6. Physical data for 24 July 86.

TIME (hrs)	ELEV. (cm)	VEL. (cm/s)	VOL. (cu.m)	AREA (sq.m)	TEMP. (deg)	COND. (mmhos)	D.O. (mg/l)
			ENHANCED SITE				
1843	12	24	386	1694	19.0	130	9.0
1854							
1927	79	39	2033	3012			
1948	105	39	3014	6877	18.3	95	9.3
2021	138	48	9718	26394			
2045	154	64	13111	31361			
2054	160	61	14700	32200	17.5	82	9.0
2136	177	26	19635	33400			
2204	187	0	22993	33725			
2252	174	29	19635	33400			
2337	160	38	14700	32200			
3117	170	40	17970	33200			
0005	136	40	7460	23927	17.8	92	8.8
0037	111	35	3417	9246			
0107	90	29	2344	3200	17.0	98	8.0
0158	57	19	1468	2635			
0220	36	18	979	2259	17.3	105	7.6
0304	19	11	565	1883			
			UNENHANCED SITE				
1843	12		210	909			
1908					19.1	220	7.6
1927	79		1056	1509			
1948	105		1484	2684			
2010					19.3	110	9.0
2021	138		3311	8963			
2045	154		5044	13088			
2054	160		5706	13400			
2105					18.0	90	8.4
2117	170		7053	13525			
2136	177		7730	13588			
2204	187		9095	13713			
2252	174		7730	13588			
2337	160		5706	13400			
0005	136		2896	7622			
0025					18.0	101	7.6
0037	111		1643	3688			
0107	90		1211	1594			
0136					18.0	150	7.1
0158	57		772	1337			
0220	36		521	1166			
0239					18.0	150	7.2
0304	19		305	994			

Table 7. Physical data for 14 October 86.

TIME (hrs)	ELEV. (cm)	VEL. (cm/s)	VOL. (cu.m)	AREA (sq.m)	TEMP. (deg)	COND. (mmhos)	D.O. (mg/l)
			ENHANCED SITE				
1355	22	18	565	1883	13.0	1154	10.0
1429	59	22	1468	2635			
1451	80	28	2033	3012			
1505	94	25	2344	3200	12.0	1043	9.0
1536	125	21	5349	17596			
1556	130	25	8718	26394	12.5	601	9.3
1649	145	28	10089	28458			
1718	146	0	10089	28458			
1736	143	14	10089	28458			
1834	117	24	3935	11490	12.0	758	10.0
1937	80	16	2033	3012			
2016	55		1214	2447	11.5	1027	9.8
2052	41	29	979	2259			
2112	15		386	1694	12.0	1204	9.2
			UNENHANCED SITE				
1355	22		305	994			
1420					12.5	1073	9.0
1451	80		1056	1509			
1505	94		1211	1594			
1523					13.0	1163	9.0
1556	130		2549	6280			
1615					12.5	753	9.2
1649	145		3807	10869			
1718	146	0	3807	10869			
1736	143		3807	10869			
1852					12.0	1073	9.0
1937	80		1056	1509			
2030					11.5	1124	8.2
2052	41		521	1166			
2200					11.0	1115	9.0

Table 8. Physical data for 4 December 86.

TIME (hrs)	ELEV. (cm)	VEL. (cm/s)	VOL. (cu.m)	AREA (sq.m)	TEMP. (deg)	COND. (mmhos)	D.O. (mg/l)
			ENHANCED SITE				
0600	50		1214	2447			
0623	83		2033	3012			
0640	102		2729	4508	4.0	265	13.0
0708	131		6323	21459			
0730	147		10089	28458	4.0	700	13.6
0800	171		17970	33200			
0835	184		22993	33725	4.0	400	13.2
0900	189		24682	33850			
0945	179		21310	33600			
1050	155		1311	31361	4.0	600	12.6
1130	137		8718	26394			
1236	111		3417	9246	3.0	600	13.0
1300	100		2729	4508			
1400	85		2033	3012	3.0	600	13.0
1440	81		2033	3012			
			UNENHANCED SITE				
0600	50		642	1252			
0623	83		1056	1509			
0640	102		1375	1680			
0708	131		2549	6280	4.0	500	12.6
0730	147		3807	10869			
0800	171		7053	13525	4.0	800	12.0
0835	184		9095	13713			
0900	189		9783	13775	3.5	650	12.2
0945	179		8411	13650			
1050	155		5044	13088			
1130	137		3311	8963	3.5	500	13.2
1236	111		1643	3688			
1300	100		1375	1680	3.0	600	12.2
1400	85		1056	1509			
1425					3.0	600	10.0
1440	81		1056	1509			

Table 9. Chemical data for 9 February 86.

TIME (hrs)	VOL. (cu.cm)	AREA (sq.cm)	TOC1 ppm	TOC2 ppm	TOC3 ppm	TIC1 ppm	TIC2 ppm	TIC3 ppm	DOC1 ppm	POC1 ppm
				ENHANCED SITE						
0400	226	1506								
0430			4.2	3.8	4.4	13.8	13.2	13.2		
0454	2033	3012								
0558	7460	23927								
0604										
0605			1.5	5.3	3.8	12.3	12.5	12.3	00.3	1.2
0621	10089	28458								
0713	16322	32700								
0732	14700	32200								
0734										
0737			1.6	2.7	2.2	12.3	12.5	12.1	00.4	1.2
0845	5349	17596								
0902										
0905			5.9	2.7	2.7	12.8	12.5	12.1	2.4	3.5
0959	2344	3200								
1028	1741	2824								
1033										
1035			3.1	2.9	3.7	12.5	12.7	12.5	00.9	2.2
1145	762	2071								
1212	565	1883								
				UNENHANCED SITE						
0400	123	823								
0454	1056	1509								
0524										
0530			2.9	3.2	4.8	13.2	13.2	13.0		
0558	2896	7622								
0621	3807	10869								
0645										
0650			2.5	1.9	4.0	20.0	21.5	18.1	1.3	1.2
0713	6378	13463								
0732	5706	13400								
0815										
0820			3.1	2.7	3.3	12.3	12.5	11.9	00.7	2.4
0845	2262	5174								
0931										
0935			3.3	4.0	3.3	12.8	13.3	12.8	1.6	1.7
0959	1211	1594								
1028	910	1423								
1110										
1112			3.5	4.1	3.5	13.8	14.3	13.8	1.5	2.0
1145	409	1080								
1212	305	994								

Table 10. Chemical data for 6 April 86.

TIME (hrs)	VOL. (cu.cm)	AREA (sq.cm)	TOC1 ppm	TOC2 ppm	TOC3 ppm	TIC1 ppm	TIC2 ppm	TIC3 ppm	DOC1 ppm	POC1 ppm
				ENHANCED SITE						
0132	565	1883								
0138			7.0	2.0	8.5	13.0	13.0	13.0	5.0	2.0
0217	1741	2824								
0231			8.5	9.0	10.0	11.5	11.5	12.0	5.0	3.5
0236	2033	3012								
0311	3417	9246								
0325			8.0	6.5	6.5	11.0	11.0	11.0	4.0	4.0
0403	7460	23927								
0421	8718	26394								
0439	8718	26394								
0512	6325	21459								
0532	5349	17596								
0538			8.5	6.5	8.0	11.5	11.5	11.0	4.5	4.0
0614	2729	4508								
0630			6.0	6.5	5.5	12.0	11.5	12.0	5.0	1.0
0714	1741	2824								
0753	1214	2447								
0800			7.5	6.5	8.5	11.5	12.5	12.5	4.0	3.5
0840	565	1883								
				UNENHANCED SITE						
0132	305	994								
0202			7.0	7.5	7.0	16.0	16.0	16.0		
0217	910	1423								
0236	1056	1509								
0256			7.5	9.0	7.0	14.0	14.0	14.0	7.0	0.5
0311	1643	3688								
0350			7.0	6.0	7.0	12.0	12.0	12.0	4.0	3.0
0403	2896	7622								
0421	3311	8963								
0439	3311	8963								
0512	2549	6280								
0532	2262	5174								
0600			7.5	6.5	7.0	11.5	12.5	12.5	4.0	3.5
0614	1375	1680								
0702			7.0	6.0	6.5	13.0	14.0	13.5	5.0	2.0
0714	910	1423								
0753	642	1252								
0830			8.0	7.0	5.0	13.0	13.0	14.0	3.5	4.5
0840	305	994								

Table 11. Chemical data for 4 May 86.

TIME (hrs)	VOL. (cu.cm)	AREA (sq.cm)	TOC1 ppm	TOC2 ppm	TOC3 ppm	TIC1 ppm	TIC2 ppm	TIC3 ppm	DOC1 ppm	POC1 ppm
				ENHANCED SITE						
0052	386	1694	6.0	6.5	8.8	27.3	30.5	26.8	5.0	3.8
0132	1214	2447	6.8	5.8	8.8	15.3	15.8	15.5	5.8	3.0
0151	1468	2635								
0222	2344	3200								
0242	3014	6877	6.3	4.8	9.3	14.0	14.5	14.0	5.5	3.8
0337	7460	23927								
0401	8718	26394								
0413	10089	28458								
0440	11564	30521								
0526	8718	26394	6.5	5.5	9.0	14.0	14.5	13.5	4.0	5.0
0618	3935	11490								
0656	2344	3200	6.8	7.3	11.8	14.8	14.8	14.8	5.0	6.8
0746	1468	2635								
0803	979	2259	6.5	11.5	9.8	15.8	16.0	14.5	5.0	4.8
0854	226	1506								
				UNENHANCED SITE						
0052	210	909								
0117			7.5	4.8	6.5	28.8	31.8	31.0	7.0	0.0
0132	642	1252								
0151	772	1337								
0206			9.3	7.0	10.0	19.0	20.3	19.5	4.0	6.0
0222	1211	1594								
0242	1484	2684								
0300			6.8	5.8	6.3	15.5	15.6	15.3	4.5	1.8
0337	2896	7622								
0401	3311	8963								
0413	3807	10869								
0440	4398	12775								
0526	3311	8963								
0558			6.0	5.8	6.0	15.5	15.3	15.3	7.0	0.0
0618	1833	3878								
0656	1211	1594								
0726			5.8	5.3	6.3	19.0	19.5	18.5	4.0	2.3
0746	772	1337								
0803	521	1166								
0833			6.8	7.0	6.3	20.5	19.3	19.0	4.8	1.5
0854	123	823								

Table 12. Chemical data for 27 June 86.

TIME (hrs)	VOL. (cu.cm)	AREA (sq.cm)	TOC1 ppm	TOC2 ppm	TOC3 ppm	TIC1 ppm	TIC2 ppm	TIC3 ppm	DOC1 ppm	POC1 ppm
				ENHANCED SITE						
1945	386	1694	9.4	6.9	7.4	14.3	14.3	14.0	5.5	1.9
2030	1741	2824								
2055	2729	4508	6.5	4.9	6.9	9.3	9.4	9.3	6.0	0.9
2139	8718	26394								
2151	13111	31361	5.9	6.2	6.6	9.1	9.1	9.3	5.2	1.4
2221	17970	33200								
2235	21310	33600								
2305	24682	33850								
0002	22993	33725								
0102	16322	32700	6.3	6.1	7.4	9.4	9.4	9.4	6.5	0.9
0138	10089	28458								
0228	3935	11490	6.9	6.3	6.5	9.7	10.1	9.7	5.1	1.4
0308	2344	3200								
0354	1468	2635	6.8	6.0	6.9	10.6	10.8	10.3	6.0	0.9
0436	1214	2447								
				UNENHANCED SITE						
1945	210	909								
2008			8.3	7.8	7.9	15.3	16.7	16.2	7.6	0.3
2030	910	1423								
2055	1375	1680								
2125			7.3	6.5	6.5	9.0	9.1	9.3	5.8	0.7
2139	3311	8963								
2151	5044	13088								
2206			6.9	6.3	6.1	9.1	9.0	9.0	5.0	1.1
2221	7053	13525								
2235	8411	13650								
2305	9783	13775								
0002	9095	13713								
0102	6378	13463								
0125			6.9	4.6	6.0	9.7	9.7	9.5	5.9	0.1
0138	3807	10869								
0228	1833	3878								
0252			7.4	6.8	7.5	11.4	11.7	11.2	6.6	0.9
0308	1211	1594								
0354	772	1337								
0417			7.1	7.3	7.9	12.6	12.6	12.0	6.4	1.5
0436	642	1252								

Table 13. Chemical data for 24 July 86.

TIME (hrs)	VOL. (cu.cm)	AREA (sq.cm)	TOC1 ppm	TOC2 ppm	TOC3 ppm	TIC1 ppm	TIC2 ppm	TIC3 ppm	DOC1 ppm	POC1 ppm
				ENHANCED SITE						
1843	386	1694								
1854			6.2	5.8	6.3	10.6	10.5	10.5	5.2	1.1
1927	2033	3012								
1948	3014	6877	5.6	5.8	5.8	9.2	9.2	9.2	5.2	0.6
2021	9718	26394								
2045	13111	31361								
2054	14700	32200	5.5	6.2	5.9	9.1	9.1	9.2	5.1	0.8
2136	19635	33400								
2204	22993	33725								
2252	19635	33400								
2337	14700	32200								
3117	17970	33200								
0005	7460	23927	5.7	4.4	5.9	9.8	9.8	9.8	4.8	1.1
0037	3417	9246								
0107	2344	3200	5.3	6.4	6.3	10.2	10.5	10.1	5.8	0.5
0158	1468	2635								
0220	979	2259	6.6	6.6	6.3	11.2	11.2	10.5	5.9	0.4
0304	565	1883								
				UNENHANCED SITE						
1843	210	909								
1908			7.2	8.0	8.3	14.5	17.8	13.4	5.7	2.6
1927	1056	1509								
1948	1484	2684								
2010			7.5	6.7	6.1	10.7	10.3	10.4	5.8	0.3
2021	3311	8963								
2045	5044	13088								
2054	5706	13400								
2105			5.7	6.7	6.6	9.1	9.1	9.2	5.3	1.3
2117	7053	13525								
2136	7730	13588								
2204	9095	13713								
2252	7730	13588								
2337	5706	13400								
0005	2896	7622								
0025			6.1	6.1	6.6	10.1	10.2	9.9	5.6	1.0
0037	1643	3688								
0107	1211	1594								
0136			7.9	7.2	8.0	11.5	11.7	11.2	6.6	1.4
0158	772	1337								
0220	521	1166								
0239			7.0	8.4	8.1	11.6	11.5	11.3	7.2	0.9
0304	305	994								

Table 14. Chemical data for 14 October 86.

TIME (hrs)	VOL. (cu.cm)	AREA (sq.cm)	TOC1 ppm	TOC2 ppm	TOC3 ppm	TIC1 ppm	TIC2 ppm	TIC3 ppm	DOC1 ppm	POC1 ppm
				ENHANCED SITE						
1355	565	1883	3.9	3.9	3.9	14.2	13.8	13.9	3.8	0.1
1429	1468	2635								
1451	2033	3012								
1505	2344	3200	3.4	3.7	4.3	13.6	13.7	13.5	3.8	0.5
1536	5349	17596								
1556	8718	26394	2.9	3.7	4.3	14.2	13.7	13.7	4.1	0.2
1649	10089	28458								
1718	10089	28458								
1736	10089	28458								
1834	3935	11490	4.1	4.2	3.7	13.6	13.5	13.7	3.3	0.4
1937	2033	3012								
2016	1214	2447	7.6	5.9	4.8	14.0	14.3	13.8	4.1	0.7
2052	979	2259								
2112	386	1694	5.6	4.8	6.1	13.7	14.7	14.0	3.8	2.3
				UNENHANCED SITE						
1355	305	994								
1420			6.5	5.4	5.5	15.8	15.7	15.4	5.0	0.5
1451	1056	1509								
1505	1211	1594								
1523			4.9	4.4	5.2	14.2	14.9	15.0	4.0	1.2
1556	2549	6280								
1615			4.4	4.5	5.2	13.3	13.3	13.4	3.7	1.5
1649	3807	10869								
1718	3807	10869								
1736	3807	10869								
1852			5.8	5.0	4.2	13.5	13.8	14.1	4.0	0.2
1937	1056	1509								
2030			4.6	5.8	5.8	15.3	15.8	14.9	5.1	0.7
2052	521	1166								
2200			9.9	8.0	7.5	16.3	17.8	15.8	5.1	2.4

Table 15. Chemical data for 4 December 86.

TIME (hrs)	VOL. (cu.cm)	AREA (sq.cm)	TOC1 ppm	TOC2 ppm	TOC3 ppm	TIC1 ppm	TIC2 ppm	TIC3 ppm	DOC1 ppm	POC1 ppm
				ENHANCED SITE						
0600	1214	2447								
0623	2033	3012								
0640	2729	4508	5.4	5.2	4.6	11.3	11.3	11.5	3.5	1.1
0708	6323	21459								
0730	10089	28458	6.0	7.7	6.9	11.6	11.6	11.5	5.4	1.5
0800	17970	33200								
0835	22993	33725	4.5	4.4	4.2	11.5	11.6	11.4	2.8	1.4
0900	24682	33850								
0945	21310	33600								
1050	1311	31361	4.5	6.2	7.1	11.5	11.5	11.5	4.9	2.2
1130	8718	26394								
1236	3417	9246	3.7	3.6	4.8	11.9	12.0	12.0	3.4	1.4
1300	2729	4508								
1400	2033	3012	4.7	5.4	5.9	11.9	11.5	11.6	5.1	0.8
1440	2033	3012								
				UNENHANCED SITE						
0600	642	1252								
0623	1056	1509								
0640	1375	1680								
0708	2549	6280	6.6	5.1	8.1	11.5	11.3	11.2	6.4	1.7
0730	3807	10869								
0800	7053	13525	5.9	5.5	5.3	11.1	11.2	11.3	4.5	0.8
0835	9095	13713								
0900	9783	13775	5.0	4.9	6.4	11.5	11.1	11.0	3.9	2.5
0945	8411	13650								
1050	5044	13088								
1130	3311	8963	5.9	8.7	6.5	11.3	11.5	11.4	5.4	1.1
1236	1643	3688								
1300	1375	1680	5.9	5.7	5.8	12.5	12.5	12.5	4.9	0.9
1400	1056	1509								
1425			5.2	4.4	4.3	12.4	13.0	12.5	3.9	0.4
1440	1056	1509								

Table 16. Invertebrate/detritus data for 9 February 86.

INVERTEBRATE/DETRITUS DATA FOR SAMPLING DATE: 09/02/86

ITEM	FLOOD		EBB	
	NUMBER	WEIGHT	NUMBER	WEIGHT
ENHANCED SITE				
EOGAMMARUS CONFERVICOLUS	156	349.1	47	70.6
COROPHIUM SALMONIS	2	2.1	1	0.3
NEOMYSIS MERCEDIS	5	84	2	6.6
DETRITUS		1903.8		4192.9
UNENHANCED SITE				
DETRITUS		49.8		101.8
EOGAMMARUS CONFERVICOLUS	17	34	5	9.3
CULICIDAE ADULT			1	0.9
PULMONATE GASTROPOD			1	
COLLEMBOLA	1	0.2		

Invertebrates = mg fresh wt.
Detritus = mg ash-free dry wt.

Table 17. Invertebrate/detritus data for 6 April 86.

INVERTEBRATE/DETRITUS DATA FOR SAMPLING DATE: 06/04/86

ITEM	FLOOD		EBB	
	NUMBER	WEIGHT	NUMBER	WEIGHT
ENHANCED SITE				
DETRITUS		142.6		3070.4
GNORIMOSPHAEROMA OREGONENSIS	1	7.7		
NEOMYSIS MERCEDIS	7	138.3	2	10.2
EOGAMMARUS CONFERVICOLUS	69	631.8	27	173.1
CORIXIDAE			2	7.5
CULICIDAE ADULT			1	0.7
UNENHANCED SITE				
DETRITUS		40.9		6.5
CORIXIDAE	2	8.3	1	4.7
GASTEROSTEUS ACULEATUS	1	352.2		

Invertebrates = mg fresh wt.
Detritus = mg ash-free dry wt.

Table 18. Invertebrate/detritus data for 4 May 86.

INVERTEBRATE/DETRITUS DATA FOR SAMPLING DATE: 04/05/86

ITEM	FLOOD		EBB	
	NUMBER	WEIGHT	NUMBER	WEIGHT
ENHANCED SITE				
ONCORHYNCHUS GORBUSCHA	2	186.5	1	46.2
NEOMYSIS MERCEDIS	1	13.2		
GNORIMOSPHAEROMA OREGONENSIS	3	63.2	2	1.5
COROPHIUM SALMONIS	6	5.2	2	1.3
EOGAMMARUS CONFERVICOLUS	204	345.9	35	27.5
CORIXIDAE	1	5.0	6	24.2
COLEOPTERA ADULT	2	34.6		
ACARI	5	2.2		
CHIRONOMID LARVAE	14	12.2		
DETRITUS		454.0		6177.3
UNENHANCED SITE				
DETRITUS		NEGLI.		23.9
EOGAMMARUS CONFERVICOLUS	10	3.5	2	0.3
CHIRONOMID LARVAE	2	1.7		
CORIXIDAE			1	20.0
CHIRONOMID PUPAE			1	1.9

Invertebrates = mg fresh wt.
Detritus = mg ash-free dry wt.

Table 19. Invertebrate/detritus data for 26 June 86.

INVERTEBRATE/DETRITUS DATA FOR SAMPLING DATE: 26/06/86

ITEM	FLOOD		EBB	
	NUMBER	WEIGHT	NUMBER	WEIGHT
ENHANCED SITE				
NEOMYSIS MERCEDIS	630	2027.2	62	266.9
DIPTERAN PUPAE	36	68.4	3	5.6
CHIRONOMID LARVAE	18	12.9	7	4.5
EPHEMEROPTERA NYMPH	1	2.5		
EOGAMMERUS CONFERVICOLUS	11	17.1	2	6.2
CHIRONOMID ADULT	2	1.5		
CORIXIDAE	23	94.0	16	32.8
DIPTERAN LARVAE	1	0.8		
EPHEMEROPTERA ADULT	1	2.4		
GNORIMOSPHAEROMA OREGONENSIS	1	40.0		
GASTEROSTEUS ACULEATUS			7	13.9
HIRUDINAE			1	2.9
COROPHIUM SALMONIS			1	1.2
ODONATA NYMPH			1	2.3
DETRITUS		16793.2		5171.8
UNENHANCED SITE				
NEOMYSIS MERCEDIS			2	7.1
CHIRONOMID LARVAE	10	6.9	8	8.0
CORIXIDAE	5	2.9	15	26.9
ACARI			9	7.1
PELECYPOD			1	0.8
EOGAMMARUS CONFERVICOLUS	1	1.9	2	1.5
GNORIMOSPHAEROMA OREGONENSIS	1	30.9		
DIPTERAN PUPAE	3	2.1		
DETRITUS		203.2		132.5

Invertebrates = mg fresh wt.
Detritus = mg ash-free dry wt.

Table 20. Invertebrate/detritus data for 24 July 86.

INVERTEBRATE/DETRITUS DATA FOR SAMPLING DATE: 24/07/86

ITEM	FLOOD		EBB	
	NUMBER	WEIGHT	NUMBER	WEIGHT
ENHANCED SITE				
NEOMYSIS MERCEDIS	26	91.0	155	500.3
DIPTERAN PUPAE	7	11.4	13	16.9
CHIRONOMID LARVAE			12	9.8
CORIXIDAE			18	32.7
GNORIMOSPHAEROMA OREGONENSIS			1	20.2
GASTEROSTEUS ACULEATUS			4	12.4
HIRUDINAE			1	0.9
EOGAMMERUS CONFERVICOLUS	9	11.1		
DIPTERAN ADULT	2	6.2		
DETRITUS		8203.1		7133.6
UNENHANCED SITE				
ONCORHYNCHUS FRY			5	14.5
NEOMYSIS MERCEDIS			8	28.0
EOGAMMERUS CONFERVICOLUS	1	3.2	4	2.8
DIPTERAN PUPA	4	8.2	4	6.3
CORIXIDAE	7	4.5	2	10.4
ACARI	1	0.5		
DIPTERAN ADULT	3	7.1		
DETRITUS		99.9		112.7

Invertebrates = mg fresh wt.
Detritus = mg ash-free dry wt.

Table 21. Invertebrate/detritus data for 14 October 86.

INVERTEBRATE/DETRITUS DATA FOR SAMPLING DATE: 14/10/86

ITEM	FLOOD		EBB	
	NUMBER	WEIGHT	NUMBER	WEIGHT
ENHANCED SITE				
NEOMYSIS MERCEDIS	5	23.6	36	173.8
CORIXIDAE			3	16.9
GNORIMOSPHAEROMA OREGONENSIS			2	11.1
DETRITUS		718.2		15744.9
UNENHANCED SITE				
NEOMYSIS MERCEDIS	8	37.1		
CHIRONOMID LARVAE	1	1.2	2	1.6
ODONADA NYMPH			1	2.3
GNORIMOSPHAEROMA OREGONENSIS	1	3.2		
CORIXIDAE	1	1.9		
DETRITUS		8.2		135.8

Invertebrates = mg fresh wt.
Detritus = mg ash-free dry wt.

Table 22. Invertebrate/detritus data for 4 December 86.

INVERTEBRATE/DETRITUS DATA FOR SAMPLING DATE: 04/12/86

ITEM	FLOOD		EBB	
	NUMBER	WEIGHT	NUMBER	WEIGHT
ENHANCED SITE				
NEOMYSIS MERCEDIS	58	541.4	3	31.2
EOGAMMERUS CONFERVICOLUS	425	2724.9	10	24.5
COROPHIUM SALMONIS	4	2.9	1	1.3
DETRITUS		10669.9		3614.1
UNENHANCED SITE				
EOGAMMERUS CONFERVICOLUS	17	52.2		
CHIRONOMID LARVAE			1	0.9
CORIXIDAE	5	40.0		
NEOMYSIS MERCEDIS			3	14.1
DETRITUS		602.5		100.3

Invertebrates = mg fresh wt.
Detritus = mg ash-free dry wt.

Table 23. Fish catch record for 4-5 May 86.

FISH CATCH RECORD FOR 2200 MAY 4 TO 0900 MAY 5, 1986

SPECIES		TOTAL CATCH	PER 1000 cu.m.	PER 1000 sq.m.
ENHANCED SITE				
PINK (Oncorhynchus gorbuscha)	-->	269	197.14	119.34
SOCKEYE (Oncorhynchus nerka)	-->	43	31.51	19.08
CHUM (Oncorhynchus keta)	-->	25	18.32	11.09
LONGFIN SMELT (Spirinchus thaleichthys)		20	14.66	8.87
COHO (Oncorhynchus kisutch)	-->	19	13.92	8.43
3-SPINE STICKLE. (Gasterosteus aculeatus)		17	12.46	7.54
CHINOOK (Oncorhynchus tshawaytscha)	-->	16	11.73	7.10
PRICKLY SCLUPIN (Cottus asper)		8	5.86	3.55
PEAMOUTH CHUB (Mylocheilus caurinus)		7	5.13	3.11
STAGHORN SCULPIN (Leptocottus armatus)		1	0.73	0.44
STARRY FLOUNDER (Platichthys stellatus)		1	0.73	0.44
UNENHANCED SITE				

DENSITY PER VOL. (ENHANCED SITE) = TOTAL CATCH/2729 cu.m. * 2.0
(UNENHANCED SITE) = TOTAL CATCH/1375 cu.m. * 2.0
DENSITY PER AREA (ENHANCED SITE) = TOTAL CATCH/4508 sq.m. * 2.0
(UNENHANCED SITE) = TOTAL CATCH/1680 sq.m. * 2.0

FISH CATCH RECORD FOR 2200 MAY 4 TO 0900 MAY 5, 1986

UNENHANCED SITE

- no data recorded -

Table 24. Fish catch record for 18-19 May 86.

FISH CATCH RECORD FOR 1930 MAY 18 TO 0900 MAY 19, 1986

SPECIES	TOTAL CATCH	PER 1000 cu.m.	PER 1000 sq.m.
ENHANCED SITE			
3-SPINE STICKLE. (Gasterosteus aculeatus)	21	15.39	9.32
PINK (Oncorhynchus gorbuscha) -->	11	8.06	4.88
CHINOOK (Oncorhynchus tshawaytscha) -->	9	6.60	3.99
PEAMOUTH CHUB (Mylocheilus caurinus)	5	3.66	2.22
REDSIDE SHINER (Richardsonius balteatus)	4	2.93	1.77
EULACHON (Thaleichthtys pacificus)	3	2.20	1.33
CHUM (Oncorhynchus keta) -->	2	1.47	0.89
LONGFIN SMELT (Spirinchus thaleichthys)	2	1.47	0.89
BROWN CATFISH (Ictalurus nebulosus)	1	0.73	0.44
RIVER LAMPREY (Lampetra ayresi)	1	0.73	0.44
UNENHANCED SITE			
3-SPINE STICKLE. (Gasterosteus aculeatus)	620	901.82	738.10
REDSIDE SHINER (Richardsonius balteatus)	121	176.00	144.05
PEAMOUTH CHUB (Mylocheilus caurinus)	114	165.82	135.71
PRICKLY SCLUPIN (Cottus asper)	32	46.55	38.10
BROWN CATFISH (Ictalurus nebulosus)	2	2.91	2.38
LARGESCALE SUCKER (Catostomus macrocheilus)	2	2.91	2.38
CHINOOK (Oncorhynchus tshawaytscha) -->	2	2.91	2.38
RIVER LAMPREY (Lampetra ayresi)	1	1.45	1.19
BRASSY MINNOW (Hybognathus hankinsoni)	1	1.45	1.19
CARP (Cyprinus carpio)	1	1.45	1.19
SOCKEYE (Oncorhynchus nerka) -->	1	1.45	1.19

DENSITY PER VOL. (ENHANCED SITE) = TOTAL CATCH/2729 cu.m. * 2.0
(UNENHANCED SITE) = TOTAL CATCH/1375 cu.m. * 2.0
DENSITY PER AREA (ENHANCED SITE) = TOTAL CATCH/4508 sq.m. * 2.0
(UNENHANCED SITE) = TOTAL CATCH/1680 sq.m. * 2.0

Table 25. Fish catch record for 21-22 May 86.

FISH CATCH RECORD FOR 2235 MAY 21 TO 1200 MAY 22, 1986

SPECIES		TOTAL CATCH	PER 1000 cu.m.	PER 1000 sq.m.
ENHANCED SITE				
CHINOOK (Oncorhynchus tshawaytscha)	-->	43	31.51	19.08
CHUM (Oncorhynchus keta)	-->	24	17.59	10.65
3-SPINE STICKLE. (Gasterosteus aculeatus)		18	13.19	7.99
LONGFIN SMELT (Spirinchus thaleichthys)		11	8.06	4.88
PRICKLY SCLUPIN (Cottus asper)		9	6.60	3.99
PINK (Oncorhynchus gorbuscha)	-->	5	3.66	2.22
PEAMOUTH CHUB (Mylocheilus caurinus)		3	2.20	1.33
REDSIDE SHINER (Richardsonius balteatus)		2	1.47	0.89
BRASSY MINNOW (Hybognathus hankinsoni)		2	1.47	0.89
BROWN CATFISH (Ictalurus nebulosus)		1	0.73	0.44
UNENHANCED SITE				
3-SPINE STICKLE. (Gasterosteus aculeatus)		86	125.09	102.38
REDSIDE SHINER (Richardsonius balteatus)		21	30.55	25.00
CHINOOK (Oncorhynchus tshawaytscha)	-->	38	55.27	45.24
CHUM (Oncorhynchus keta)	-->	15	21.82	17.86
PEAMOUTH CHUB (Mylocheilus caurinus)		10	14.55	11.90
PRICKLY SCLUPIN (Cottus asper)		5	7.27	5.95
LONGFIN SMELT (Spirinchus thaleichthys)		4	5.82	4.76
BROWN CATFISH (Ictalurus nebulosus)		3	4.36	3.57
SOCKEYE (Oncorhynchus nerka)	-->	3	4.36	3.57
BRASSY MINNOW (Hybognathus hankinsoni)		2	2.91	2.38
PINK (Oncorhynchus gorbuscha)	-->	2	2.91	2.38
LARGESCALE SUCKER (Catostomus macrocheilus)		1	1.45	1.19
EULACHON (Thaleichthys pacificus)		1	1.45	1.19

DENSITY PER VOL. (ENHANCED SITE) = TOTAL CATCH/2729 cu.m. * 2.0
(UNENHANCED SITE) = TOTAL CATCH/1375 cu.m. * 2.0
DENSITY PER AREA (ENHANCED SITE) = TOTAL CATCH/4508 sq.m. * 2.0
(UNENHANCED SITE) = TOTAL CATCH/1680 sq.m. * 2.0

Table 26. Fish catch record for 1-2 June 86.

FISH CATCH RECORD FOR 2000 hrs June 1 TO 1015 hrs June 2, 1986

SPECIES		TOTAL CATCH	PER 1000 cu.m.	PER 1000 sq.m.
ENHANCED SITE				
PRICKLY SCLUPIN (Cottus asper)		75	54.97	33.27
CHINOOK (Oncorhynchus tshawaytscha)	-->	150	109.93	66.55
SOCKEYE (Oncorhynchus nerka)	-->	200	146.57	88.73
3-SPINE STICKLE. (Gasterosteus aculeatus)		38	27.85	16.86
PEAMOUTH CHUB (Mylocheilus caurinus)		13	9.53	5.77
STARRY FLOUNDER (Platichthys stellatus)		9	6.60	3.99
CHUM (Oncorhynchus keta)	-->	13	9.53	5.77
REDSIDE SHINER (Richardsonius balteatus)		3	2.20	1.33
LONGFIN SMELT (Spirinchus thaleichthys)		2	1.47	0.89
UNENHANCED SITE				
SOCKEYE (Oncorhynchus nerka)	-->	393	571.64	467.86
CHINOOK (Oncorhynchus tshawaytscha)	-->	68	98.91	80.95
PRICKLY SCLUPIN (Cottus asper)		28	40.73	33.33
REDSIDE SHINER (Richardsonius balteatus)		12	17.45	14.29
3-SPINE STICKLE. (Gasterosteus aculeatus)		11	16.00	13.10
CHUM (Oncorhynchus keta)	-->	8	11.64	9.52
LONGFIN SMELT (Spirinchus thaleichthys)		1	1.45	1.19
BROWN CATFISH (Ictalurus nebulosus)		1	1.45	1.19
STARRY FLOUNDER (Platichthys stellatus)		1	1.45	1.19

DENSITY PER VOL. (ENHANCED SITE) = TOTAL CATCH/2729 cu.m. * 2.0
(UNENHANCED SITE) = TOTAL CATCH/1375 cu.m. * 2.0
DENSITY PER AREA (ENHANCED SITE) = TOTAL CATCH/4508 sq.m. * 2.0
(UNENHANCED SITE) = TOTAL CATCH/1680 sq.m. * 2.0

Table 27. Fish catch record for 15-16 June 86.

FISH CATCH RECORD FOR 1730 JUNE 15 TO 0830 JUNE 16, 1986

SPECIES		TOTAL CATCH	PER 1000 cu.m.	PER 1000 sq.m.
ENHANCED SITE				
3-SPINE STICKLE. (Gasterosteus aculeatus)		45	32.98	19.96
REDSIDE SHINER (Richardsonius balteatus)		40	29.31	17.75
PRICKLY SCLUPIN (Cottus asper)		39	28.58	17.30
PEAMOUTH CHUB (Mylocheilus caurinus)		32	23.45	14.20
SOCKEYE (Oncorhynchus nerka)	-->	93	68.16	41.26
CHINOOK (Oncorhynchus tshawaytscha)	-->	28	20.52	12.42
LARGESCALE SUCKER (Catostomus macrocheilus)		1	0.73	0.44
EULACHON (Thaleichthtys pacificus)		1	0.73	0.44
UNENHANCED SITE				
SOCKEYE (Oncorhynchus nerka)	-->	112	162.91	133.33
REDSIDE SHINER (Richardsonius balteatus)		45	65.45	53.57
PRICKLY SCLUPIN (Cottus asper)		31	45.09	36.90
3-SPINE STICKLE. (Gasterosteus aculeatus)		16	23.27	19.05
PEAMOUTH CHUB (Mylocheilus caurinus)		4	5.82	4.76
CHINOOK (Oncorhynchus tshawaytscha)	-->	3	4.36	3.57
BROWN CATFISH (Ictalurus nebulosus)		1	1.45	1.19

DENSITY PER VOL. (ENHANCED SITE) = TOTAL CATCH/2729 cu.m. * 2.0
(UNENHANCED SITE) = TOTAL CATCH/1375 cu.m. * 2.0
DENSITY PER AREA (ENHANCED SITE) = TOTAL CATCH/4508 sq.m. * 2.0
(UNENHANCED SITE) = TOTAL CATCH/1680 sq.m. * 2.0

Table 28. Fish catch record for 29-30 June 86.

FISH CATCH RECORD FOR 1810 hrs June 29 TO 0845 hrs June 30, 1986

SPECIES		TOTAL CATCH	PER 1000 cu.m.	PER 1000 sq.m.
ENHANCED SITE				
PRICKLY SCLUPIN (Cottus asper)		22	16.12	9.76
3-SPINE STICKLE. (Gasterosteus aculeatus)		22	16.12	9.76
SOCKEYE (Oncorhynchus nerka)	-->	44	32.25	19.52
STARRY FLOUNDER (Platichthys stellatus)		1	0.73	0.44
CHINOOK (Oncorhynchus tshawaytscha)	-->	2	1.47	0.89
UNENHANCED SITE				
3-SPINE STICKLE. (Gasterosteus aculeatus)		134	194.91	159.52
PEAMOUTH CHUB (Mylocheilus caurinus)		91	132.36	108.33
PRICKLY SCLUPIN (Cottus asper)		52	75.64	61.90
REDSIDE SHINER (Richardsonius balteatus)		36	52.36	42.86
LARGESCALE SUCKER (Catostomus macrocheilus)		34	49.45	40.48
SOCKEYE (Oncorhynchus nerka)	-->	22	32.00	26.19
CARP (Cyprinus carpio)		2	2.91	2.38
CHINOOK (Oncorhynchus tshawaytscha)	-->	4	5.82	4.76
COHO (Oncorhynchus kisutch)	-->	2	2.91	2.38

DENSITY PER VOL. (ENHANCED SITE) = TOTAL CATCH/2729 cu.m. * 2.0
(UNENHANCED SITE) = TOTAL CATCH/1375 cu.m. * 2.0
DENSITY PER AREA (ENHANCED SITE) = TOTAL CATCH/4508 sq.m. * 2.0
(UNENHANCED SITE) = TOTAL CATCH/1680 sq.m. * 2.0

Table 29. Chum fry length weight statistical summary (E = enhanced, U = unenhanced).

CHUM (Oncorhyncus keta)

LENGTH-WEIGHT STATISTICAL SUMMARY

SITE	E	E	E	E	U	U	E	E	U	U
DATE	MAY 19	MAY 19	MAY 22	MAY 22	MAY 22	MAY 22	JUN 2	JUN 2	JUN 2	JUN 2
MEASURE	LENGTH	WEIGHT	LENGTH	WEIGHT	LENGTH	WEIGHT	LENGTH	WEIGHT	LENGTH	WEIGHT
n	2	2	24	24	15	15	13	13	8	8
MEAN	37.00	0.41	37.88	0.41	39.73	0.57	36.62	0.42	34.50	0.40
MAXIMUM	37.00	0.45	42.00	0.61	62.00	2.00	47.00	0.91	41.00	0.58
MINIMUM	37.00	0.36	34.00	0.32	34.00	0.32	28.00	0.15	29.00	0.20
VARIANCE	0.00	0.00	4.20	0.00	47.64	0.17	18.42	0.03	18.57	0.01
STD. DEV.	0.00	0.06	2.05	0.07	6.90	0.42	4.29	0.17	4.31	0.11
STD.ERR.	0.00	0.04	0.42	0.01	1.78	0.11	1.19	0.05	1.52	0.04
95% C.L.	0.00	0.00	0.87	0.02	3.82	0.24	2.59	0.11	3.59	0.09

Table 30. Pink fry length weight statistical summary (E = enhanced, U = unenhanced).

PINK (Oncorhyncus gorbuscha)

LENGTH-WEIGHT STATISTICAL SUMMARY

SITE	E	E	E	E	E	E	U	U
DATE	MAY 5	MAY 5	MAY 19	MAY 19	MAY 22	MAY 22	MAY 22	MAY 22
MEASURE	LENGTH	WEIGHT	LENGTH	WEIGHT	LENGTH	WEIGHT	LENGTH	WEIGHT
n	51	51	11	11	5	5	2	2
MEAN	32.745	0.252	33.000	0.242	32.200	0.218	32.500	0.240
MAXIMUM	35.000	0.310	36.000	0.290	33.000	0.240	34.000	0.280
MINIMUM	31.000	0.160	30.000	0.180	31.000	0.180	31.000	0.200
VARIANCE	1.394	0.001	2.400	0.001	0.700	0.001	4.500	0.003
STD. DEV.	1.181	0.031	1.549	0.029	0.837	0.023	2.121	0.057
STD. ERR.	0.165	0.004	0.467	0.009	0.374	0.010	1.500	0.040
95% C.L.	0.330	0.009	1.400	0.020	1.039	0.028	19.059	0.358

Table 31. Sockeye fry length weight statistical summary (E = enhanced, U = unenhanced).

SOCKEYE (Oncorhyncus nerka)

LENGTH-WEIGHT STATISTICAL SUMMARY

SITE	U	U	U	U	E	E	U	U
DATE	MAY 19	MAY 19	MAY 22	MAY 22	JUN 2	JUN 2	JUN 2	JUN 2
MEASURE	LENGTH	WEIGHT	LENGTH	WEIGHT	LENGTH	WEIGHT	LENGTH	WEIGHT
n	1	1	3	3	200	200	393	393
MEAN	29.00	0.17	28.00	0.16	28.05	0.16	28.01	0.18
MAXIMUM	29.00	0.17	30.00	0.21	37.00	0.51	40.00	0.60
MINIMUM	29.00	0.17	26.00	0.12	25.00	0.08	24.00	0.07
VARIANCE			4.00	0.00	4.35	0.00	6.62	0.01
STD. DEV.			2.00	0.05	2.09	0.07	2.57	0.08
STD. ERR.			1.15	0.03	0.15	0.00	0.13	0.00
95% C.L.			4.05	0.09	0.29	0.01	0.25	0.01

SITE	E	E	U	U	E	E	U	U
DATE	JUN 16	JUN 16	JUN 16	JUN 16	JUN 30	JUN 30	JUN 30	JUN 30
MEASURE	LENGTH	WEIGHT	LENGTH	WEIGHT	LENGTH	WEIGHT	LENGTH	WEIGHT
n	93	93	112	112	44	44	21	21
MEAN	31.88	0.30	30.96	0.27	36.66	0.44	38.62	0.50
MAXIMUM	43.00	0.71	41.00	0.72	45.00	0.85	49.00	0.94
MINIMUM	27.00	0.10	24.00	0.12	24.00	0.10	32.00	0.26
VARIANCE	8.21	0.01	7.90	0.01	23.25	0.03	18.95	0.03
STD. DEV.	2.87	0.10	2.81	0.10	4.82	0.18	4.35	0.18
STD. ERR.	0.30	0.01	0.27	0.01	0.73	0.03	0.95	0.04
95% C.L.	0.59	0.02	0.52	0.02	1.45	0.05	1.93	0.08

Table 32. Chinook fry length weight statistical summary (E = enhanced, U = unenhanced).

CHINOOK (Oncorhyncus tshawaytscha)
"fry" (ie. less than 65 mm)
LENGTH-WEIGHT STATISTICAL SUMMARY

SITE	E	E	E	E	U	U	E	E	U	U	E	E
DATE	MAY 5	MAY 5	MAY 19	MAY 19	MAY 19	MAY 19	MAY 22	MAY 22	MAY 22	MAY 22	JUN 2	JUN 2
MEASURE	LENGTH	WEIGHT	LENGTH	WEIGHT	LENGTH	WEIGHT	LENGTH	WEIGHT	LENGTH	WEIGHT	LENGTH	WEIGHT
n	11	11	9	9	2	2	36	36	34	34	148	148
MEAN	41.64	0.75	43.67	0.94	45.50	0.88	43.78	0.85	42.88	0.90	46.03	1.12
MAXIMUM	45.00	1.00	52.00	1.62	48.00	0.99	57.00	1.62	56.00	2.02	64.00	3.44
MINIMUM	39.00	0.62	38.00	0.52	43.00	0.77	36.00	0.40	37.00	0.52	31.00	0.24
VARIANCE	4.05	0.12	4.90	0.37	2.50	0.11	4.45	0.30	4.63	0.33	5.49	0.50
STD. DEV.	2.01	0.34	2.21	0.61	1.58	0.33	2.11	0.54	2.15	0.57	2.34	0.71
STD. ERR.	0.61	0.10	0.74	0.20	1.12	0.23	0.35	0.09	0.37	0.10	0.19	0.06
95% C.L.	1.36	0.22	1.71	0.46	14.23	2.92	0.71	0.18	0.76	0.20	0.37	0.12

SITE	U	U	E	E	U	U	E	E	U	U
DATE	JUN 2	JUN 2	JUN 16	JUN 16	JUN 16	JUN 16	JUN 30	JUN 30	JUN 30	JUN 30
MEASURE	LENGTH	WEIGHT	LENGTH	WEIGHT	LENGTH	WEIGHT	LENGTH	WEIGHT	LENGTH	WEIGHT
n	68	68	26	26	3	3	2	2	4	4
MEAN	41.69	0.79	52.04	1.78	47.33	1.21	51.50	1.67	57.50	1.81
MAXIMUM	53.00	1.76	64.00	3.44	58.00	2.34	57.00	2.14	63.00	2.63
MINIMUM	32.00	0.29	34.00	0.38	42.00	0.44	46.00	1.19	53.00	1.03
VARIANCE	4.81	0.33	6.36	0.67	7.54	0.82	5.50	0.47	3.57	0.58
STD. DEV.	2.19	0.58	2.52	0.82	2.75	0.90	2.35	0.69	1.89	0.76
STD. ERR.	0.27	0.07	0.49	0.16	1.59	0.52	1.66	0.49	0.94	0.38
95% C.L.	0.54	0.14	1.01	0.33	6.84	2.24	21.09	6.23	2.99	1.21

Table 33. Chinook smolt length weight statistical summary (E = enhanced, U = unenhanced).

CHINOOK (Oncorhyncus tshawaytscha)
"smolt" (ie. greater than 65 mm)
LENGTH STATISTICAL SUMMARY

SITE	E	E	U	E	E
DATE	MAY 5	MAY 22	MAY 22	JUN 2	JUN 16
n	1	7	4	2	2
MEAN	95.00	97.57	104.50	71.00	72.00
MAXIMUM	95.00	125.00	137.00	74.00	78.00
MINIMUM	95.00	68.00	86.00	68.00	66.00
VARIANCE		558.29	500.33	18.00	72.00
STD. DEV.		23.63	22.37	4.24	8.49
STD. ERR.		8.93	11.18	3.00	6.00
95% C.L.		21.85	35.57	38.12	76.24

Table 34. Stomach contents of juvenile salmon caught May 19, 1986.

Fish #	Len. (mm)	Wt. (g)	Prey Item
UNENHANCED SITE			
Chinook			
1	48	0.99	legs of adult insect (diptera)
2	43	0.77	legs of adult insect (diptera)
Sockeye			
1	29	0.17	3 culicid pupa (mosquito) 24 harpacticoid copepods 1 diptera adult 1 isopod
ENHANCED SITE			
Chum			
1	36	0.35	2 diptera pupa 2 dipter adult
2	37	0.45	1 chironomid larva 31 harpacticoid copepods 1 diptera adult
Pink			
1	34	0.26	1 harpacticoid copepod
2	34	0.28	1 chironomid adult
3	34	0.26	1 harpacticoid copepod 1 small stone (detritus)
4	34	0.21	1 diptera adult
5	33	0.22	25 harpacticoid copepods
6	31	0.24	1 harpacticoid copepod
7	33	0.21	empty stomach
8	34	0.22	empty stomach
9	32	0.24	1 chironomid adult 1 acari 25 harpacticoid copepods
10	32	0.21	empty stomach
11	30	0.16	1 harpacticoid copepod
Chinook			
1	51	143	1 corophium 2 diptera 1 chironomid adult 1 chironomid larva

Table 34. continued

Fish #	Len. (mm)	Wt. (g)	Prey Item
Enhanced site (cont.)			
Chinook (Cont.)			
			1 chironomid pupa
			1 hemiptera, homopter larva
			1 legs of other item
2	51	1.50	6 chironomid adult
			2 chironomid larva
3	47	0.99	3 chironomid pupa
			4 chironomid larva
			3 chironomid adult
			4 culicid pupa
			2 coleoptera adults
			1 eogammarus confer.
4	45	0.85	1 chironomid larva
			1 chironomid adult
			1 ephemeroptera larva
			1 hemiptera, homoptera larva
			1 corophium
5	43	0.69	1 chironomid adult
6	42	0.78	2 chironomid larva
			3 culicid pupa
			3 chironomid adult
7	39	0.47	3 collembola
			2 chironomid pupa
			2 chironomid adult
			1 culicid pupa
			1 chironomid larva
8	40	0.58	1 collembola
			8 chironomid adult
9	41	0.58	2 chironomid adult
			1 chironomid pupa

Table 35. Stomach contents of juvenile salmon caught May 22, 1986.

Fish #	Len. (mm)	Wt. (g)	Prey Item
UNENHANCED SITE			
Sockeye			
1	27	0.12	1 chironomid larva
			1 chironomid adult
			6 harpacticoid copepods
2	26	0.10	empty stomach
3	30	0.21	1 diptera pupa
			2 cladocera
			8 harpacticoid copepods
Pink			
1	35	0.31	2 chironomid adult
			2 harpacticoid copepods
2	32	0.21	8 harpacticoid copepods
Chum			
1	39	0.42	3 culicid pupa
			11 chironomid adult
			2 collembola
			1 chironomid larva
			1 diptera pupa
			3 copepod nauplii
2	62	1.88	4 eogammarus conf.
			2 hymenoptera adults
3	39	0.48	1 collembola
			1 diptera pupa
			1 ephemoroptera larva
4	46	0.79	2 eogammarus conf.
			2 harpacticoid copepods
			1 chrionomid adult
5	37	0.39	1 chironomid larva
			2 chironomid adult
6	44	0.57	1 eogammarus confer.
			6 harpacticoid copepods
			1 chironomid pupa
			1 chironomid adult
7	40	0.41	1 salmon fry
			1 collembola
			1 chironomid adult
8	41	0.46	1 chironomid larva
			1 collembola

Table 35. continued.

Fish #	Len. (mm)	Wt. (g)	Prey Item
UNENHANCED SITE (cont.)			
Chum (cont.)			
9	37	0.38	1 ephemeropter larva
			1 chironomid adult
			1 harpacticoid copepod
			2 cladocera
			2 eogammarus conf.
10	38	0.42	1 copepod nauplii
			1 collembola
			1 chironomid larva
			1 harpacticoid copepod
11	36	0.29	2 collembola
			6 harpacticoid copepod
			1 cladocera
12	38	0.38	6 eogammarus conf.
			4 chironomid larva
			1 hemiptera larva
13	36	0.36	1 harpacticoid copepod
			2 chironomid larva
			1 cladocera
			1 chironomid adult
14	37	0.38	3 salmon fry
			3 cyclopoid copepods
			2 harpacticoid copepods
			2 copopod nauplii
15	35	0.34	1 hemiptera larva
			1 harpacticoid copepod
			1 chironomid pupa
			2 chironomid adult
			1 copepod nauplii
			1 chironomid larva
Chinook			
1	137	74.4	3 eogammarus conf.
			2 chironomid adult
2	99	12.1	1 tipulidae larva
			1 eogammarus conf.
			4 hemiptera, homoptera larva
			1 salmon fry
			1 chironomid adult
			1 chironomid larva
3	86	7.70	1 salmon fry

Table 35. continued.

Fish #	Len. (mm)	Wt. (g)	Prey Item
UNENHANCED SITE (cont.)			
Chinook (cont.)			
4	96	10.2	1 earthworm
			3 eogammarus conf.
5	56	1.95	1 isopoda
			1 chironomid larva
			1 chironomid pupa
			3 harpacticoid copepod
			1 ceratopogonid larva
			3 ceratopogonid adult
6	47	1.09	12 collembola
			2 ceratopogonid adult
			1 ceratopogonid pupa
7	47	1.14	6 collembola
			3 chironmoid adult
			2 hemiptera, homoptera larva
			2 diptera adult
			1 ceratopogonid adult
			1 ceratopogonid larva
8	50	1.28	1 acarid
			1 hemiptera
			2 diptera adult
9	46	1.05	12 fish fry (small smelt)
			1 chironomid pupa
			1 eogammarus conf.
			3 hemiptera, homoptera
			1 simulid adult
			2 collembola
			2 chironomid adult
10	44	0.80	4 collembola
			1 harpacticoid
			3 chironomid adult
			1 hemiptera, homoptera
			1 parasitic hymenoptera
			1 acari
11	42	0.70	1 chironomid pupa
			1 chironomid adult
12	49	0.89	1 chironomid adult
			1 ceratopogonid adult
			1 hemiptera, homoptera larva
13	39	0.60	1 collembola
			1 hemiptera, homoptera larva

Table 35. continued.

Fish #	Len. (mm)	Wt. (g)	Prey Item
UNENHANCED SITE (cont.)			
Chinook (cont.)			
			1 nematode
			2 chironomid adult
			1 hymenoptera
			1 simulid adult
			1 collembola
			1 diptera adult
14	28	0.54	1 hemiptera, homonoptera larva
			1 collembola
			3 chironomid adult
			1 diptera adult
			1 ceratopogonid adult
15	40	0.65	5 hemiptera, homoptera larva
			1 ceratopogonid larva
			3 collembola
			2 chironomid adult
16	41	0.67	1 diptera larva
			4 collembola symphheplcora
			1 collembola artheopleocora
			9 chironomid adult
			3 ceratopogonid adult
			4 homoptera larva
17	40	0.62	2 collembola
			3 chironomid adult
			3 homoptera larva
18	40	0.63	2 homoptera larva
			2 chironomid adults
19	50	1.46	1 collembola
			1 chironomid adult
			1 homoptera larva
			1 hymenoptera adult
ENHANCED SITE			
Pink			
1	32	0.21	1 chironomid adult
2	32	0.22	empty
3	31	0.15	1 chironomid larvae
			1 harpacticoid copepod
4	32	0.22	1 chironomid larvae
			3 chironomid adult

Table 35. continued.

Fish #	Len. (mm)	Wt. (g)	Prey Item
ENHANCED SITE (cont.)			
Pink (cont.)			
4 (cont.)			1 harpacticoid copepod
5	34	0.22	1 diptera adult
Chum			
1	42	0.56	2 chironomid adult
			9 collembola
			1 ceratopogonid adult
2	37	0.36	1 chironomid larvae
			2 harpacticoid copepod
			1 chironomid adult
3	38	0.40	2 collembola
			1 chironomid pupa
			1 chironomid adult
4	40	0.45	1 chironomid pupa
			4 collembola
			1 homoptera larva
			1 chironomid adult
5	39	0.49	1 homoptera larva
			1 chironomid larvae
			1 chironomid adult
6	38	0.37	1 chironomid adult
			10 collembola
			1 homoptera
7	41	0.45	3 chironomid adult
			1 collembola
			1 chironomid larva
8	35	0.37	2 chironomid adult
9	43	0.61	4 collembola
			2 chironomid adult
10	39	0.42	2 harpacticoid copepods
			4 collembola
			1 diptera pupa
			1 chironomid adult
11	40	0.40	3 chironomid adult
			1 collembola
12	39	0.41	1 coleoptera adult
			1 eogammarus conf.
			2 homoptera larva
			32 collembola
			1 chironomid adult

Table 35. continued.

Fish #	Len. (mm)	Wt. (g)	Prey Item
ENHANCED SITE (cont.)			
Chum (cont.)			
13	36	0.31	1 arachnid
			1 eogammarus conf.
			1 chironomid adult
14	38	0.41	14 collembola
			2 chironomid larva
			2 harpacticoid copepods
			1 chironomid adult
15	37	0.31	3 chironomid adult
			1 chironomid pupa
			3 harpacticoid copepod
Chinook			
1	120	19.54	1 hemiptera; heteroptera adult
			2 corophium
			1 neomysis mercedis
			1 diptera adult
2	124	19.52	2 heteroptera adult
			1 chironomid adult
			1 eogammarus conf.
			1 ceratopogonid larva
3	75	5.22	1 eogammarus conf.
			2 chironomid adult
4	49	1.17	13 collembola
			19 chironomid adult
			1 ceratopogonid adult
			4 diptera adult
			1 homoptera adult
5	50	1.42	1 collembola
			1 simulid adult
			2 chironomid pupa
			2 diptera adult
			13 collembola
			5 chironmoid adult
			1 chironomid larva
6	53	1.56	8 chironomid adult
			1 diptera adult; dolichopus
			6 collembola
			4 diptera adult; stratiomyidae
			1 chironomid pupa
			1 ceratopogonid adult

Table 35. continued.

Fish #	Len. (mm)	Wt. (g)	Prey Item
ENHANCED SITE (cont.)			
Chinook (cont.)			
7	43	0.78	1 homoptera adult 7 chironomid adult 1 collembola
8	53	1.52	4 collembola 3 chironomid adult 1 collembola
9	40	0.65	21 collembola 13 chironomid adult 3 chironomid pupa 4 ceratopogonid adult 1 homoptera larva
10	52	1.27	1 diptera adult; protoplasa 3 homoptera larva 30 collembola 16 chironomid adult 1 chironomid pupa 2 cetatopogonid adult 1 arachnid 1 diptera adult
11	41	0.55	3 chironomid adult
12	45	1.09	40 collembola 1 homoptera larva 9 chironomid adult 1 ceratopogonid adult 2 hymenoptera adult 1 chironomid pupa
13	44	0.80	9 collembola 1 homoptera larva 1 diptera pupa 6 chironmomic adult 1 ceratopogonid adult
14	44	0.78	1 plecoptera nymph 13 collembola 1 chironomid larva 7 chironomid adult 1 homoptera larva
15	39	0.48	18 collembola 7 chironomid adult 1 homoptera larva 1 ceratopogonid adult

Table 35. continued.

Fish #	Len. (mm)	Wt. (g)	Prey Item
ENHANCED SITE (cont.)			
Chinook (cont.)			
16	38	0.58	5 collembola
			4 chironomid adult
			1 homoptera larva
17	40	0.57	2 collemobla
			5 chironomid adult
			1 diptera adult; protoplasa
			2 homoptera larva

Table 36. Stomach contents of juvenile salmon caught June 2, 1986.

Fish #	Len. (mm)	Wt. (g)	Prey Item
UNENHANCED SITE			
Chum			
1	38	0.43	1 collembola
			1 chironomid adult
2	40	0.56	1 chironomid adult
			1 homoptera adult
3	33	0.39	1 chironomid adult
4	36	0.42	2 chironomid adult
			1 homoptera adult
			2 homoptera larva
			1 chironomid larva
5	32	0.34	1 chironomid adult
			2 diptera pupa
			1 ceratopogonid adult
Chinook			
1	52	1.35	1 arachnid
			1 pecoptera nymph
			1 homoptera adult
			1 diptera adult
			1 chironomid adult
2	46	0.94	1 diptera adult
			1 homopter larva
3	41	0.64	3 chironomid adult
			2 homoptera adult
			1 diptera pupa
			1 homoptera larva
4	53	1.74	2 chironomid adult
			1 homoptera adult
5	42	0.72	1 chironomid adult
			1 plecoptera nymph
			1 homoptera adult
			1 homoptera larva
			1 cetatopogonid adult
			1 collembola
6	36	0.40	1 chironomid adult
7	41	0.71	1 neomysis mercedis
			1 collemobla
			1 homoptera larva
8	37	0.54	1 homoptera larva
			1 homoptera adult

Table 36. continued.

Fish #	Len. (mm)	Wt. (g)	Prey Item
UNENHANCED SITE (cont.)			
Chinook (cont.)			
9	44	0.96	1 neomysis mercedis
			1 chironomid larva
10	45	1.01	5 chironomid adult
			3 homoptera adult
			1 diptera pupa
11	37	0.53	1 acari
			1 collembola
			1 homoptera larva
			1 coleoptera larva
			2 chironomid larva
			1 homoptera adult
			1 diptera pupa
12	47	1.20	2 fish fry (smelt)
			1 diptera pupa
			1 collembola
			2 chironomid adult
13	39	1.36	1 chironomid larva
			1 chironomid adult
			1 homoptera adult
14	36	0.48	2 chironomid adult
15	37	0.48	2 homoptera adult
			1 chironomid adult
Sockeye			
1	33	0.35	1 homoptera larva
			3 homoptera adult
			1 arachnid
			3 chironomid adult
2	26	0.13	2 chironomid adult
3	28	0.13	1 chironomid adult
			2 chironomid larva
			12 harpacticoid copepods
			6 cladocera
4	29	0.18	1 chironomid adult
5	27	0.12	1 acari
			1 chironomid adult
			1 diptera pupa
			3 harpacticoid copepods
			2 cladocera

Table 36. continued.

Fish #	Len. (mm)	Wt. (g)	Prey Item
UNENHANCED SITE (cont.)			
Sockeye (cont.)			
6	16	0.10	9 cladorcera
7	27	0.15	1 collembola
			1 chironomid adult
			1 chironomid pupa
			1 cladocera
8	28	0.10	1 chironomid adult
			1 cladocera
9	31	0.29	1 chironomid larva
			1 homoptera larva
			1 hymenoptera; Apsilops sp.
			1 chironomid adult
			5 cladocera
			1 harpacticoid copepod
10	32	0.25	1 chironomid adult
			1 collembola
			1 cladocera
			3 harpacticoid copepod
11	28	0.11	empty
12	26	0.11	1 collemola
			1 cladocera
13	28	0.16	3 harpacticoid copepod
14	27	0.10	12 cladocera
			3 harpacticoid copepod
15	27	0.12	7 collembola
			1 cladocera
			1 harpacticoid copepod
ENHANCED SITE			
Chum			
1	36	0.40	1 arachnid
2	38	0.38	1 collembola
			2 chironomid larva
			1 homoptera larva
			1 homoptera adult
			1 chironomid adult
			1 ceratopogonid adult
3	39	0.45	1 diptera adult
4	38	0.40	3 chironomid adult
5	47	0.86	1 collembola

Table 36. continued.

Fish #	Len. (mm)	Wt. (g)	Prey Item
ENHANCED SITE			
Chum (cont.)			
6	34	0.30	1 homoptera larva
			2 ceratopogonid adult
			2 collembola
			1 chironomid adult
7	36	0.38	2 homoptera adult
			1 chironomid adult
			1 harpacticoid copepod
8	37	0.39	2 homoptera adult
			1 chironomid adult
			1 chironomid larva
			1 collembola
9	37	0.39	2 chironomid adult
			1 homoptera larva
10	36	0.37	1 chironomid larva
			1 chironomid adult
11	32	0.32	1 eogammarus confervicolus
			1 chironomid larva
			1 collembola
12	35	0.30	2 collembola
			1 homoptera larva
			1 diptera adult
Sockeye			
1	37	0.53	1 arachnid
			3 homoptera larva
			1 diptera adult; Protoplasa sp.
			1 chironomid adult
			1 diptera adult
2	31	0.17	8 harpacticoid copepod
			1 diptera larva; dixid
			1 collembola
			3 ceratopogonid adult
3	28	0.14	1 chironomid adult
			1 homoptera adult
			1 diptera pupa
			1 calinoid copepod
4	27	0.17	1 chironomid larva
			1 chironomid adult
5	28	0.16	2 homoptera larva
			1 chironomid adult

Table 36. continued.

Fish #	Len. (mm)	Wt. (g)	Prey Item
ENHANCED SITE			
Sockeye (cont.)			
6	26	0.14	1 diptera adult; Protoplasa spp.
7	25	0.14	2 harpacticoid copepod
8	27	0.16	3 harpacticoid copepod
			1 cladocera
9	25	0.10	1 ephemeroptera nymph
10	21	0.13	11 harpacticoid copepod
			1 diptera larva
11	30	0.23	2 collembola
			1 homoptera larva
			2 chironomid adult
			1 ceratopogonid adult
12	26	0.10	1 acari
			1 homoptera larva
			2 chironomid adult
			2 harpacticoid copepod
13	29	0.09	1 chironomid adult
14	29	0.18	1 collembola
			1 harpacticoid copepod
			1 homoptera larva
			1 chironomid adult
15	31	0.41	1 eogammarus confervicolus
			2 collembola
			1 chironomid adult
Chinook			
1	56	2.07	7 homoptera adult
			6 chironomid adult
			1 hymenoptera; Apsilops
			1 chironomid pupa
			1 ceratopogonid adult
			1 homoptera larva
			2 diptera adult
			1 plecoptera adult
			1 diptera larva
			1 collembola
2	53	1.83	3 neomysis mercedis
3	49	1.20	7 chironomid adult
			4 homoptera adult
4	47	1.15	3 neomysis mercedis
			1 homoptera adult

Table 36. continued.

Fish #	Len. (mm)	Wt. (g)	Prey Item
ENHANCED SITE			
Chinook (cont.)			
5	48	1.10	1 neomysis mercedis
			2 chironomid adult
6	46	1.00	2 neomysis mercedis
7	54	1.66	2 trichoptera larva
8	43	0.73	1 homoptera larva
			1 chironomid adult
			1 homoptera adult
9	67	3.55	1 chironomid pupa
			4 neomysis mercedis
			7 homoptera adult
			1 diptera adult
			2 chironomid adult
10	42	0.80	2 collembola
			1 chironomid pupa
11	56	2.09	4 neomysis mercedis
			1 diptera adult
12	57	2.04	4 chironomid adult
			2 homoptera larva
			1 homoptera adult
			1 diptera larva
			1 plecoptera adult
13	53	1.79	7 neomysis mercedis
14	45	0.96	1 plecoptera nymph
			2 homoptera adult
			1 chironomid adult
15	41	0.67	1 neomysis mercedis
			2 chironomid adult
			1 diptera adult; Protoplasa spp.

Table 37. Stomach contents of juvenile salmon caught June 16, 1986.

Fish #	Len. (mm)	Wt. (g)	Prey Item
UNENHANCED SITE			
Chinook			
1	57	2.25	1 plecoptera nymph
			2 chironomid adult
2	43	0.79	1 collembola
			3 chironomid adult
3	36	0.42	1 diptera adult; Atherix spp.
			2 chironomid adult
Sockeye			
1	28	0.17	1 chironomid adult
			1 chironomid larva
			1 harpacticoid copepod
2	28	0.18	2 chironomid larva
			1 acari
			7 cladocera
			19 harpactocoid copepod
3	36	0.38	2 chironomid larva
			2 chironomid adult
			1 diptera pupa
			2 harpacticoid copepod
4	39	0.52	2 diptera adult
			1 chironomid adult
			1 nematode
			2 chironomid larva
			1 cladocera
			7 harpacticoid copepod
5	40	0.63	3 chironomid larva
			2 homoptera larva
			1 diptera larva; Tipulidae
			5 harpacticoid copepod
			2 cladocera
6	29	0.21	1 diptera larva; Tipulidae
			2 chironomid adult
			1 chironmoid larva
			10 harpacticoid copepod
7	38	0.49	1 chironomid larva
			2 diptera adult
			1 homoptera adult
			17 harpacticoid copepod
			2 cladocera

Table 37. continued.

Fish #	Len. (mm)	Wt. (g)	Prey Item
UNENHANCED SITE			
Sockeye (cont.)			
8	34	0.38	2 collembola
			3 ceratopogonid adult
			1 homoptera larva
			1 diptera larva
			2 diptera adult
			28 harpacticoid copepod
			5 cladocera
9	32	0.25	2 cladocera
			15 chironomid larva
			1 harpacticoid copepod
			1 diptera adult
10	28	0.15	7 chironomid larva
			1 diptera larva
			2 harpacticoid copepod
			1 cladocera
			1 chironomid adult
			1 collembola
11	34	0.37	1 homoptera adult
			7 chironomid larva
			1 chironomid pupa
			1 chironomid adult
			1 cladocera
			7 harpacticoid copepod
12	28	0.16	76 harpacticoid copepod
			1 chironomid larva
			1 chironomid adult
13	29	0.18	36 harpacticoid copepod
			1 cladocera
14	32	0.24	6 chironomid larva
			1 cladocera
			4 harpacticoid copepod
15	32	0.23	3 chironomid larva
			3 harpacticoid copepod
			4 cladocera
ENHANCED SITE			
Sockeye			
1	31	0.26	3 chironomid adult
			3 diptera adult

Table 37. continued.

Fish #	Len. (mm)	Wt. (g)	Prey Item
ENHANCED SITE (cont.)			
Sockeye (cont.)			
1	31	0.26	3 chironomid larva
			1 diptera adult
			2 harpacticoid copepod
2	37	0.32	2 chironomid adult
			1 collembola
			1 homoptera larva
			1 diptera adult
3	38	0.54	1 diptera pupa
			2 chironomid adult
			1 collembola
			1 cladocera
			43 fish fry (small smelt)
4	30	0.23	1 chironomid larva
			1 chironomid adult
			1 homoptera larva
5	38	0.38	7 homoptera larva
			4 collembola
			1 arachnid
			3 chironomid adult
			2 harpacticoid copepod
6	28	0.18	2 homoptera adult
			3 chironomid adult
7	34	0.43	3 homoptera larva
			1 chironomid adult
8	30	0.20	1 collembola
			2 chironomid adult
			4 homoptera larva
			1 acari
			1 harpacticoid copepod
9	29	0.22	1 collembola
			1 chironomid adult
			1 diptera adult
			3 homoptera larva
10	30	0.24	10 collembola
			3 chironomid adult
			13 homoptera larva
			4 harpacticoid copepod
11	38	0.47	1 diptera adult
			1 homoptera larva
			3 chironomid adult

Table 37. continued.

Fish #	Len. (mm)	Wt. (g)	Prey Item
ENHANCED SITE (cont.)			
Sockeye (cont.)			
12	31	0.26	1 diptera larva; Simulidae 5 harpacticoid copepod 2 collembola 1 homoptera larva
13	30	0.23	1 fish fry (smelt) 2 chironomid larva 2 harpacticoid copepod 1 homoptera larva
14	30	0.22	2 collembola 3 chironomid larva 3 chironomid adult 1 homoptera adult
15	32	0.34	5 collembola 2 homoptera larva 1 chironomid adult 1 chironomid larva
Chinook			
1	57	2.29	2 neomysis mercedis 41 fish fry (smelt)
2	45	1.10	1 collembola 2 homoptera adult 5 chironomid adult 3 ceratopogonid adult 1 chironomid pupa 5 homoptera larva 1 diptera larva; Simulidae
3	66	3.25	2 corophium salmonis 17 chironomid adult 1 diptera pupa
4	61	2.84	1 fish fry (smelt, 23 mm) 12 neomysis mercedis 3 chironomid larva 30 fish fry (smelt)
5	56	2.18	133 fish fry (smelt) 5 chironomid adult 1 chironomid pupa 1 coleoptera adult
6	68	3.13	6 neomysis mercedis 68 fish fry (smelt)

Table 37. continued.

Fish #	Len. (mm)	Wt. (g)	Prey Item
ENHANCED SITE (cont.)			
Chinook (cont.)			
7	56	2.28	1 plecoptera nymph 1 fish fry (large smelt) 5 neomysis mercedis 32 fish fry (smelt) 2 chironomid adult 1 diptera adult
8	56	2.08	1 plecoptera nymph 1 neomysis mercedis 71 fish fry (smelt)
9	448	1.18	3 plecoptera nymph 3 ephemeroptera nymph 2 chironomid adult
10	58	2.35	15 neomysis mercedis 7 chironomid larva 4 fish fry (smelt)
11	48	1.21	2 chironomid larva
12	59	2.64	1 chironomid pupa 2 chironomid adult 1 chironomid larva 29 fish fry (smelt) 1 collembola
13	48	1.36	3 neomysis mercedis 10 fish fry (smelt)
14	43	0.79	2 chironomid larva 2 chironomid adult 1 hymenoptera adult 1 homoptera larva
15	51	1.63	83 fish fry (smelt) 1 diptera adult

Table 38. Stomach contents of juvenile salmon caught June 30, 1986.

Fish #	Len. (mm)	Wt. (g)	Prey Item
UNENHANCED SITE			
Chinook			
1	53	1.63	4 chironomid adult
			1 diptera adult
2	56	2.05	1 hymenoptera adult
			1 fish fry (smelt)
			1 chironomid pupa
			2 diptera adult
			1 eogammarus confervicolus
3	40	0.53	1 chironomid adult
4	64	2.73	2 chironomid adult
			1 fish fry (smelt)
5	47	1.08	1 eogammarus confervicolus
Sockeye			
1	47	0.94	1 chironomid adult
			1 homoptera adult
			1 diptera adult
			1 cyclopod copepod
2	32	0.27	1 chironomid larva
			19 cyclopod copepod
			2 fish fry (smelt)
3	30	0.53	11 chironomid pupa
			6 cyclopod copepod
			1 ceratopogonid larva
			12 acari
4	39	0.50	4 cyclopod copepod
			1 chironomid adult
5	35	0.38	1 fish fry (smelt)
			1 cyclopod copepod
			3 homoptera adult
6	38	0.44	2 diptera adult
7	40	0.62	2 chironomid adult
			1 cyclopod copepod
8	39	0.54	2 acari
			1 cyclopod copepod
			2 chironomid adult
9	40	0.98	4 chironomid adult
			1 collembola
			1 acari
10	31	0.34	1 chironomid adult

Table 33. continued.

Fish #	Len. (mm)	Wt. (g)	Prey Item
UNENHANCED SITE			
Sockeye (cont.)			
11	39	0.54	2 chironomid adult
			1 cyclopoid copepod
12	40	0.60	1 harpacticoid copepod
			1 cyclopoid copepod
			2 chironomid adult
13	32	0.27	4 cyclopoid copepod
14	40	0.53	1 chironomid larva
			2 culicid pupa
			1 cyclopoid copepod
			1 chironomid adult
15	35	0.39	6 cyclopoid copepod
			1 chironomid adult
ENHANCED SITE			
Chinook			
1	56	2.10	1 plecoptera nymph
			3 chironomid adult
2	46	1.16	1 neomysis mercedis
			2 chironomid adult
Sockeye			
1	36	0.45	1 diptera larva
			9 collembola
			4 culicid pupa
			2 chironomid adult
			1 homoptera larva
			1 cyclopoid copepod
2	39	0.54	3 chironomid pupa
			1 collembola
			2 acari
3	38	0.45	1 collembola
			5 chironomid adult
			2 diptera adult
			1 chironomid larva
4	39	0.58	1 chironomid adult
5	44	0.74	1 collembola
			5 chironomid adult
			1 homoptera adult
			2 pelcoptera nymph

Table 38. continued.

Fish #	Len. (mm)	Wt. (g)	Prey Item
ENHANCED SITE			
Sockeye (cont.)			
6	46	0.91	2 collembola
			3 chironomid adult
			2 chironomid pupa
			4 chironomid larva
			3 homoptera larva
7	34	0.37	3 homoptera larva
			3 chironomid adult
			1 collembola
			1 diptera adult
8	34	0.44	2 chironomid adult
			1 chironomid larva
9	44	0.68	1 arachnid
			2 chironomid pupa
			2 chironomid larva
			4 chironomid adult
			3 homoptera larva
			2 diptera adult
			1 ceratopogonid adult
			2 collembola
10	42	0.71	2 collembola
			1 homoptera adult
			3 chironomid adult
11	39	0.59	1 collembola
			1 coleoptera larva
			5 chironomid adult
12	37	0.49	2 collembola
			1 harpacticoid copepod
			2 chironomid larva
			3 homoptera larva
			3 chironomid adult
13	43	0.86	1 chironomid larva
			1 collembola
			3 homoptera larva
			1 diptera adult; Simulidae
			5 chironomid adult
14	40	0.63	1 diptera pupa
			2 chironomid larva
			2 collembola
			2 chironomid adult
15	29	0.20	5 collembola